Kinetics and Thermodynamics of 7m MEA and 7m MEA/2m PZ Solutions

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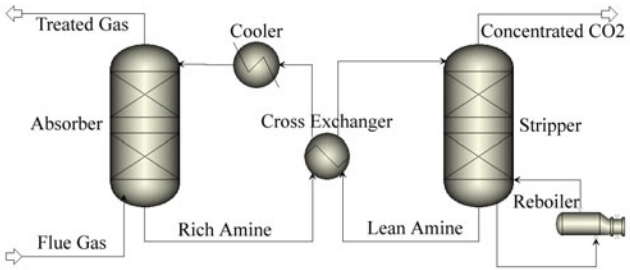
INTRODUCTION

Aqueous amine absorption/stripping is currently the best technology to remove CO_2 from the flue gas of existing coal fired power plants. It is a tail end process that will not significantly disrupt the operation of the power plant. However, this technology is expensive and would require a significant portion of the plant's generated stream to power the regeneration system. One approach to lower capital and operating costs of the system involves using advanced amine solvents.



OBJECTIVES

Wetted Wall Column

- Measure the CO_2 reaction rate and equilibrium CO_2 partial pressure of 7m MEA and 7m MEA/2m PZ solutions over a wide range of CO_2 loading at both absorber and stripper conditions (40 – 100˚C).

Closed-loop Stirred Reactor

- Measure CO_2 equilibrium partial pressure and amine volatility

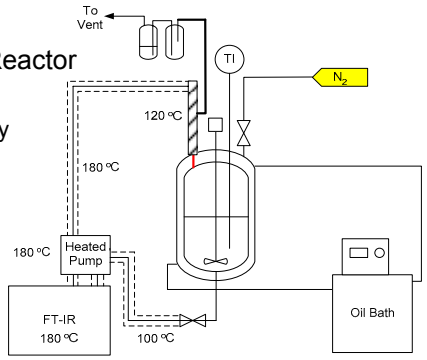
WHY 7m MEA/2m PZ?

- Faster Rates
  - Less Packing
  - Richer Solution
    - Lower Energy Requirements
- Greater Capacity
  - Lower Flow Rates
  - Smaller Heat Exchangers, Pumps

EXPERIMENTAL APPARATUS

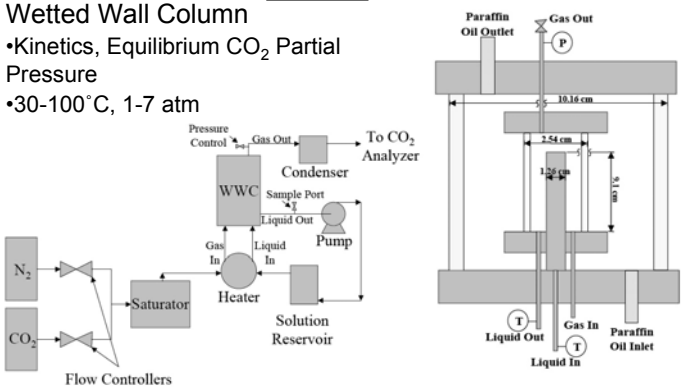
Closed-loop Stirred Reactor

- Equilibrium CO_2 Partial Pressure, Amine Volatility
- 1 atm, 30-70˚C



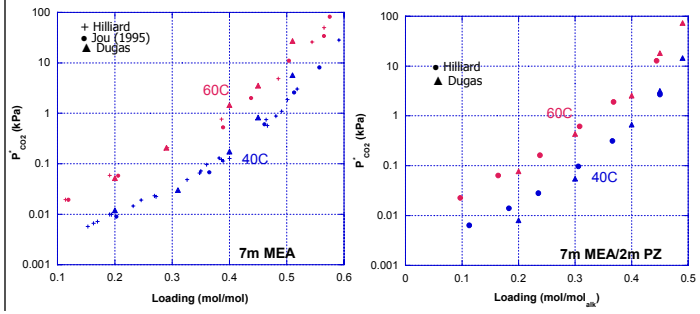
Wetted Wall Column

- Kinetics, Equilibrium CO_2 Partial Pressure
- 30-100˚C, 1-7 atm

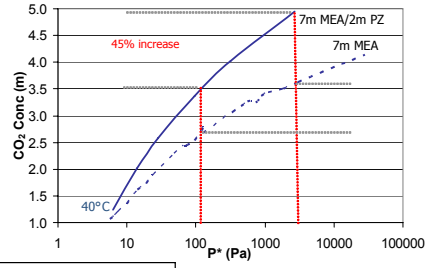


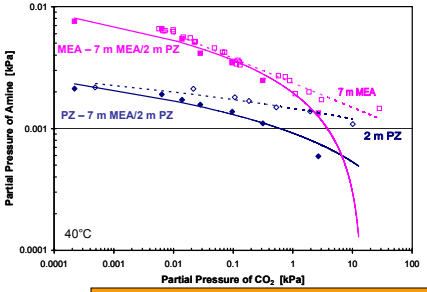
THERMODYNAMIC RESULTS

- Hilliard, Jou and Dugas VLE data match well



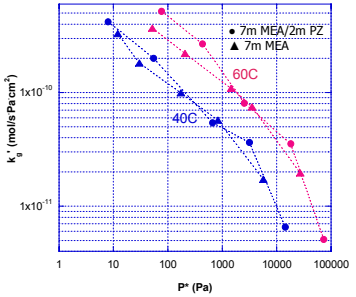
- 45% Greater CO_2 Capacity for 7m MEA/2m PZ





KINETIC RESULTS

- 7m MEA/2m PZ have faster rates than 7m MEA
- Rich end conditions (1000-5000 Pa) are most important



CONCLUSIONS

- 7m MEA/2m PZ has a 45% greater CO_2 capacity than 7m MEA
- MEA and PZ volatility was successfully quantified
- 7m MEA/2m PZ shows faster rates than 7m MEA in the most important partial pressure range, 1000 to 5000 Pa.

ACKNOWLEDGEMENTS

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